Radiation Hazard (RADHAZ) Survey

for

Naval Station Treasure Island, Ca.,

Final Report

Performed By:

Naval Electronic Systems Engineering Center, Charleston, SC

Navy Shore Electromagnetic Environmental
Task Number E88164-C078

Survey Dates: 21 June - 3 July 1988

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ABSTRACT

As requested by Western Division, Naval Facilities Engineering Command, a Radiation Hazard (RADHAZ) and Electromagnetic Compatibility (EMC) Survey was performed for the Naval Station Treasure Island and Hunters Point Annex, CA in the San Francisco Bay area. This survey was performed under the Navy Shore Electromagnetic Environmental Effects (E^3) program as task number E88164-C078 to identify areas where potential EMC and Hazardous Electromagnetic Radiation to Fuel (HERF), Ordnance (HERO), and Personnel (HERP) might exist. The prime objective of this survey was to incorporate the data obtained from the analysis into the Station Master Plan and identify any potential electromagnetic radiation hazards. On-site measurements were performed between 21 June and 3 July 1988.

Survey test results indicate that potential HERP conditions exist at Building 1 on NAVSTA Treasure Island and Building 229 on Yerba Buena Island. Also, a theoretical HERP hazard exists at 1240 Northpoint Drive and 1215 Bayside Drive on NAVSTA Treasure Island. Measurements could not be conducted at 1240 Northpoint Drive or 1215 Bayside Drive due to operational considerations of the POC at these sites.

Transmitter facilities on Naval Station Treasure Island and Hunters Point, with the exception of Coast Guard transmitter facilities and Reserve Vans, need to post RF hazard warning signs in accordance with DoD INST 6055.11 dtd 20 Aug 1986 "Protection of DoD Personnel from Exposure to Radio-frequency Radiation".

No HERO areas were identified since electrically initiated ordnance is not handled on base. HERF conditions do not exist from fixed emitters; however, possible HERF conditions could occur at the fueling area behind Building 2 from mobile or hand held transmitters. Signs should be posted near this fueling area to inform personnel that RF transmissions are not allowed within 50 feet of these gas pumps. Finally, EMC distances measured during this survey did not identify any areas of significant concern.

During the survey an RF leak was detected in the transmission line on Building 264. Although this did not represent a personnel hazard, consideration should be given to replacing this line in order to prevent potential damage to or inefficient operation of this transmitter.

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1.0 INTRODUCTION

1.1 BACKGROUND

1.1.1 As requested by reference (1.3.1), a Radiation Hazard (RADHAZ) and Electromagnetic Compatibility (EMC) Survey was performed for the Naval Station Treasure Island and Hunters Point Annex, CA in the San Francisco Bay area. This survey was performed under the Navy Shore Electromagnetic Environmental Effects (E^3) program as task number E88164-C078 to identify areas where potential EMC and Hazardous Electromagnetic Radiation to Fuel (HERF), Ordnance (HERO), and Personnel (HERP) might exist. The results of this RADHAZ/EMC survey are to be incorporated into the Station Master Plan. On-site measurements were performed between 21 June and 3 July 1988.

1.1.2 The objective of the RADHAZ/EMC survey was to determine if these facilities are in compliance with the guidelines stated in references (1.3.2 through 1.3.4).

1.2 SITE DESCRIPTION

1.2.1 Treasure Island is a man-made island located in San Francisco Bay that is connected to Yerba Buena Island on the north-west shore by a earthen causeway. Treasure Island was created for the 1939-1940 Golden Gate International Exposition. After the exposition the island was turned over to the U.S. Navy and today is used as a training station for fleet activities. Figure A2 in Appendix A depicts the location of Treasure Island.

1.2.2 Hunters Point is an annex of Naval Station Treasure Island. The annex is located on the bay shore of the San Francisco peninsula. Hunters Point was, during the Second World War, the largest naval shipyard on the West Coast. More than 600 U.S. Naval vessels were built, repaired, and maintained at Hunters Point Shipyard during World War II. Today many of Hunters Point's buildings and warehouses are leased to San Francisco businesses as a low-cost alternative to the high real estate costs of the area. Figure A2 in Appendix A depicts the location of Hunters Point .

1.3 REFERENCES

1.3.1 WESTNAVFACENGCOM ltr 11010 Ser 2023D/P2-063 dtd 29 Feb 88

1.3.2 DoD INST 6055.11 dtd 20 Aug 1986; "Protection of DoD Personnel from Exposure to Radio-frequency Radiation

1.3.3 NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010 Vol. I & II "Electromagnetic Radiation Hazards" dtd 15 July 1982

1.3.4 MIL-STD-461B Class B Part 7 EMI Limit of 1 Volt/meter 1 April 1980

1.3.5 NAVSHIPS Computer Program "On Axis Power Density in the Fresnel and Fraunhofer Region" NAVSHIPS 0900-006-5240 & NAVSHIPS 0900-006-5250. Modified by NAVELEXCEN Charleston to include communications antennas.

2.0 ANALYSIS

2.1 THEORETICAL ANALYSIS

2.1.1 Completed technical parameters sheets of only a few of the base emitters were supplied by NAVSTA Treasure Island. This allowed a limited theoretical analysis prior to conducting the on site RADHAZ/EMC survey. Theoretical calculations were performed using a NAVSEA computer program to predict the on axis power density in the Fresnel and Fraunhofer regions for radar field strength and which was modified by NAVELEXCEN Charleston to include communication field strength predictions (reference 1.3.5). These calculations assume ideal conditions, i.e. maximum power output, lossless cables, etc.; however, actual field strengths are normally much lower due to losses in each system. The objective of the pre-survey theoretical analysis was to identify possible problem areas that might be encountered during the actual field survey.

2.1.2 Theoretical distances are included in Appendix B.

2.2 TEST PROCEDURES

2.2.1 The RADHAZ/EMC survey was carried out by a survey team consisting of engineers and technicians from Naval Electronics Systems Engineering Center, Charleston, SC. This team established testing procedures and survey principles that were used throughout the survey. The following are the guidelines used by the survey team.

2.2.1.1 HERP measurements were made on all accessible transmitting antennas with an output power greater than 7 watts in accordance with reference 1.3.2. The HERP test limits, included in Appendix D for reference purposes, depict the derived equivalent Permissible Exposure Limit (PEL) for Unrestricted and Restricted Access.

2.2.1.2 HERF measurements were not made because the only fueling area on base is located a significant distance from any fixed transmitter. The HERF limits, reference 1.3.3, state that no RF transmissions are allowed within 50 feet of a fueling area from transmitters that have an output power less than 250 watts. This makes mobile and portable transmitters a potential fuel hazard on base.

2.2.1.3 HERO measurements were not made since no electrically initiated ordnance is handled on the base.

2.2.1.4 EMC measurements were made on all accessible transmitting antennas in order to determine the distance at which one volt/meter occurs (reference 1.3.4). The EMC limit of one volt/meter was used as the threshold at which a degradation in system performance would occur since no other standard was supplied by the station.

2.2.2 During the RADHAZ/ EMC survey all radiating devices tested were operated at there normal output power.

2.3 TEST EQUIPMENT

2.3.1 All test equipment utilized for the RADHAZ/ EMC survey was calibrated and in correct working order. A list of the test equipment used is located in Appendix C.

2.4 AREAS OF CONSIDERATION

2.4.1 There were three major areas of concern for RADHAZ/EMC testing, the Naval Station Treasure Island, Naval Station Treasure Island on Yerba Buena Island and Naval Station Treasure Island at Hunters Point Annex. A listing of all systems/equipments tested at these three locations is provided in Appendix B.

3.0 RESULTS

3.1 The results of this survey are contained in Appendix B. These results include measured and theoretically predicted field strengths for all known emitters on NAVSTA Treasure Island, Yerba Buena Island, and Hunters Point Annex. (Some items could not be analyzed due to operational requirements and/or conflicts in scheduling as well as the non-availability of some emitter technical parameters.) In addition, Appendix B contains theoretical predictions of "typical" shipboard emitters which may be operated by ships tied at Pier 1.

3.2 No RF Hazard Warning signs were posted at access points to any transmitter on Treasure Island, Yerba Buena Island, or Hunters Point Annex except at the Coast Guard Facility on Yerba Buena Island and on the Reserve Van.

3.3 Four significant potential HERP problems were identified during the survey. First, the AN/WRC-1 on Building 1 is located in an area which has unrestricted access to personnel and is frequently used. The hazard distance measured from this transmitter is 2.6 feet; however, personnel can easily get within on foot of this antenna. Second, the roof of the Tower Club (Building 229 on Yerba Buena Island) contains numerous emitters, see Appendices A and B, and several HERP "hot spots" were identified. This combined with the unrestricted access (tourists were observed on the roof) to the roof of this building could present potential hazardous conditions to civilian as well as Naval personnel. The third and fourth

potential HERP problems were theoretically predicted on two amateur radios at 1215 E. Bayside Drive and 1240 Northpoint Drive respectively. Field strength measurements could not be made due to scheduling conflicts.

3.4 An RF transmission line located on the roof of building 264 was found to be leaking some electromagnetic radiation during the survey. This leak did not represent a personnel hazard.

3.5 A potential HERF hazard could exist from mobile and/or hand held radios at the fueling area near Building 2.

4.0 RECOMMENDATIONS

4.1 RF Hazard Warning Signs, see Appendix D, should be posted in accordance with reference 1.3.2 near access points to all transmitting antennas with greater than seven watts effective radiated power.

4.2 Personnel should not be allowed within the hazard distance given in Appendix B of any transmitting antenna under normal circumstances. If it is determined to be operationally feasible it is recommended that the minimum safety distance from each antenna should be at least three feet.

4.3 Due to the easy access and frequent use of the area on Building 1 where the AN/WRC-1 transmitting antenna is mounted it is recommended that a three foot safety boundary be identified around this antenna. Possible ways to identify this area include a non-conducting fence or a highly visible painted boundary.

4.4 Assess to the roof of Building 229 should be restricted to authorized personnel only. This will require a device to prevent unauthorized personnel from climbing the fire escape while not preventing its use in case of an emergency. If maintenance is being performed on the roof or to the antennas on this building it is recommended that personnel maintain the safety distances given in Appendix B and avoid sitting or leaning on the metal roof cap and vent due to the coupling of RF energy onto those objects. In addition, transmitters on this roof should be silenced while workers are on the roof if possible.

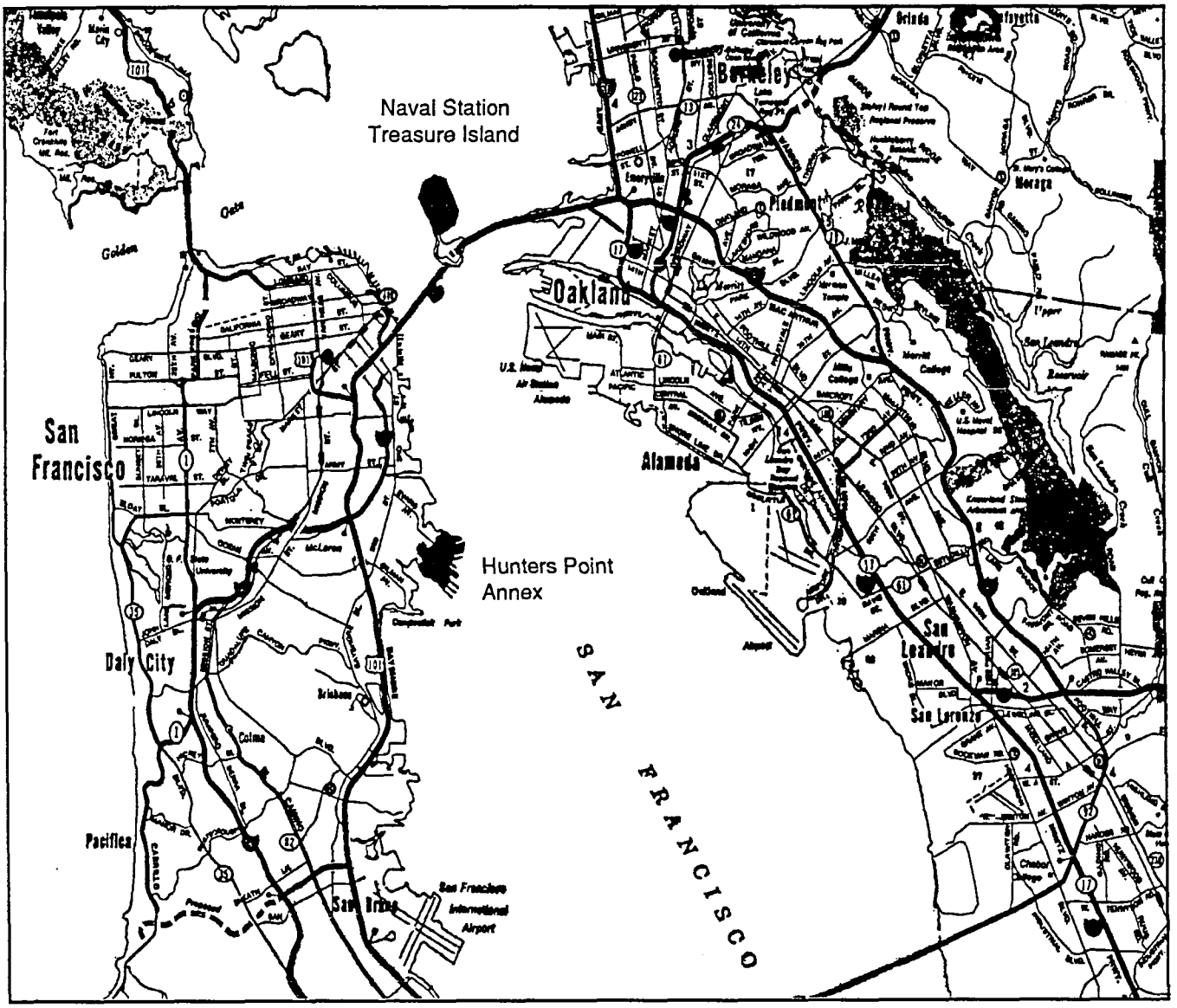
4.5 The two amateur radio operators at 1215 E. Bayside Drive and 1240 Northpoint Drive respectively should take steps to assure that personnel maintain the theoretically predicted hazard distances given in Appendix B. Relocating the antennas and/or non-conductive fencing would be the best way to handle this problem.

4.6 Although the RF leak in the transmission line on Building 264 did not represent a personnel hazard, consideration should be given to replacing this line in order to prevent potential damage to or inefficient operation of this transmitter.

4.7 All mobile and hand held radio operators should be instructed that a minimum safety distance of 50 feet is required from any fueling area with transmitters rated with less than 250 watts. In addition, these radios should be labeled to identify this potential hazard and signs to this effect should be posted at the pumps behind Building 2.

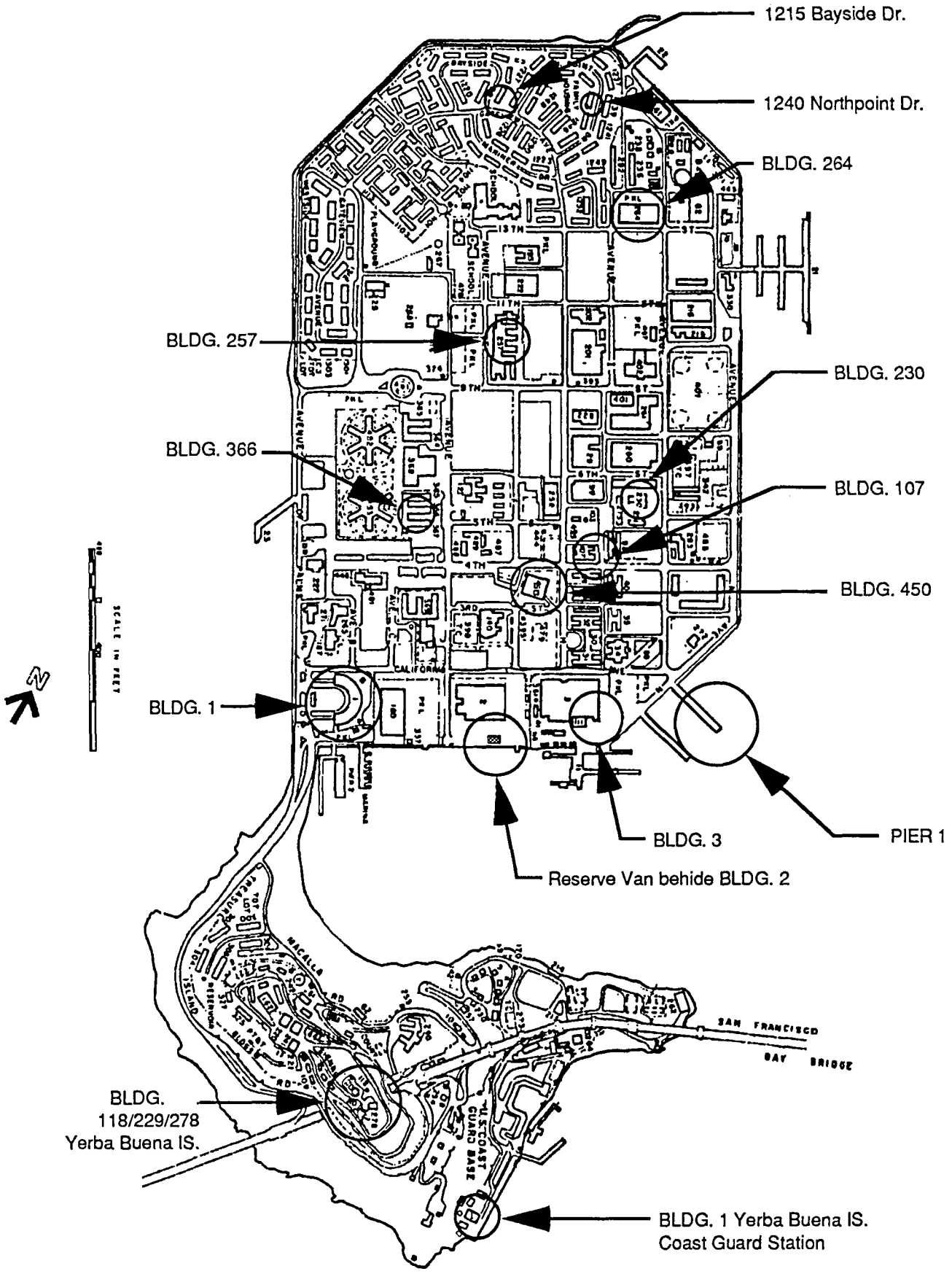
APPENDIX A

STATION MAPS



Regional Map
San Francisco, CA Bay Area

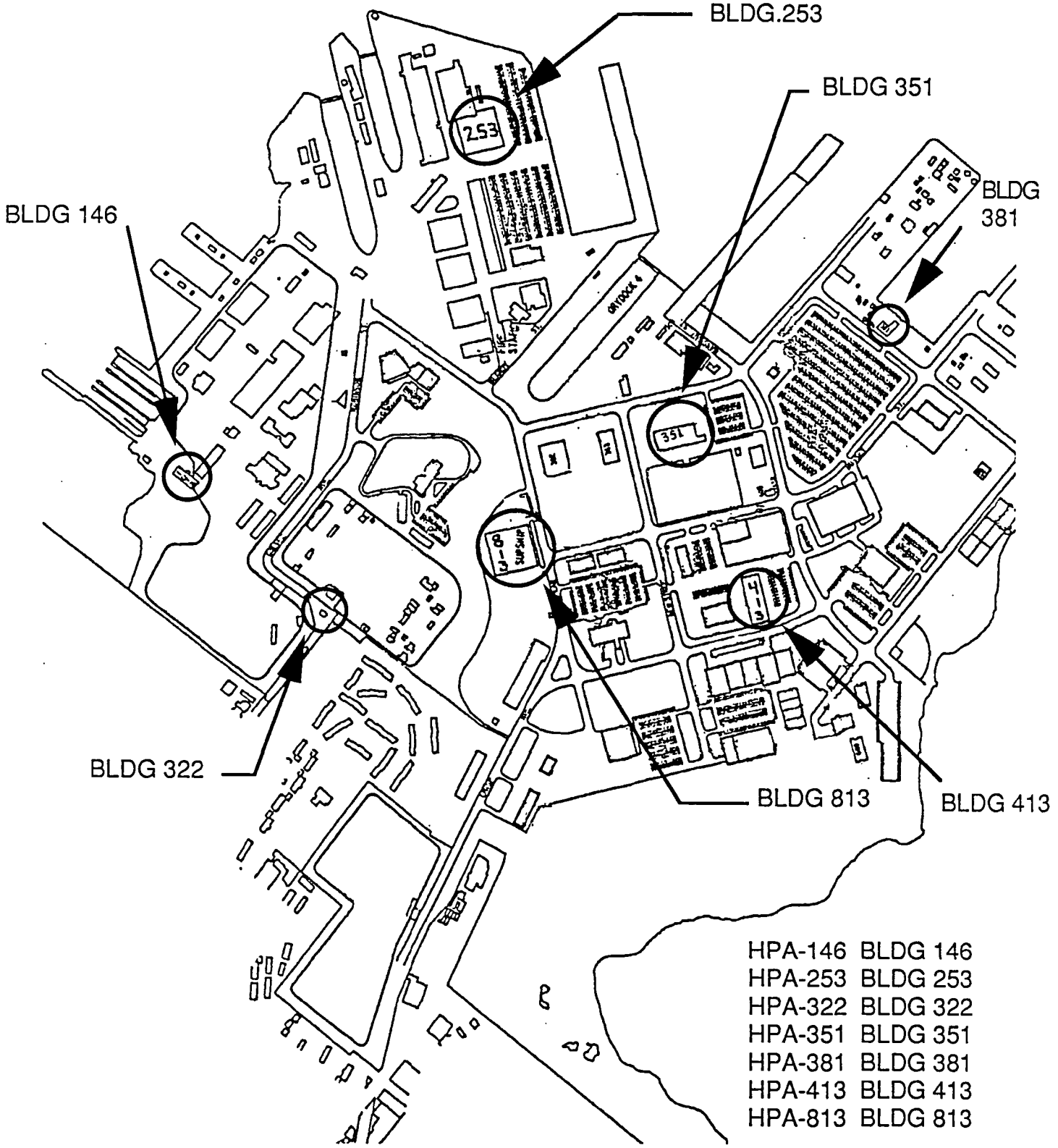
Figure A1
A2



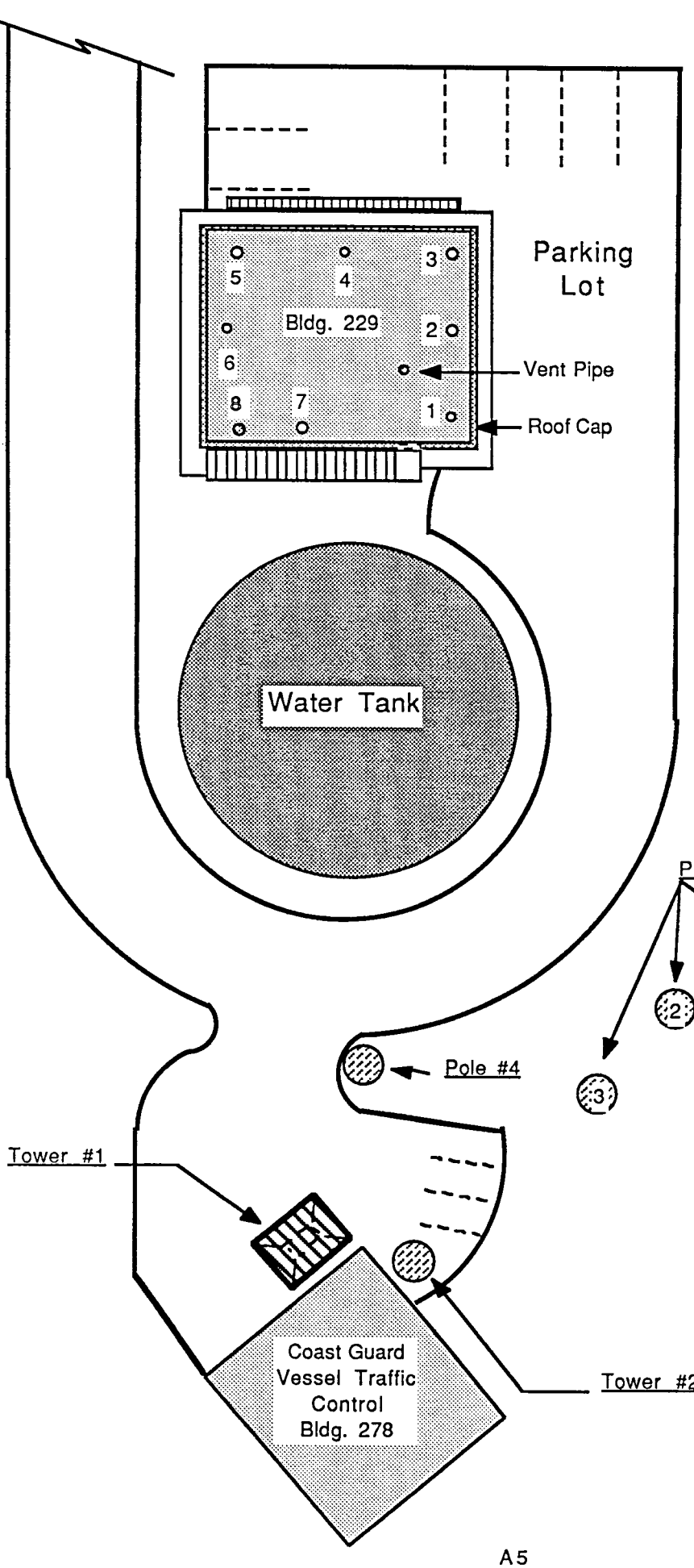
Naval Station Treasure Island and Yerba Buena Island

Figure A2

A3



Naval Station Treasure Island
Hunters Point Annex
Figure A3
A4

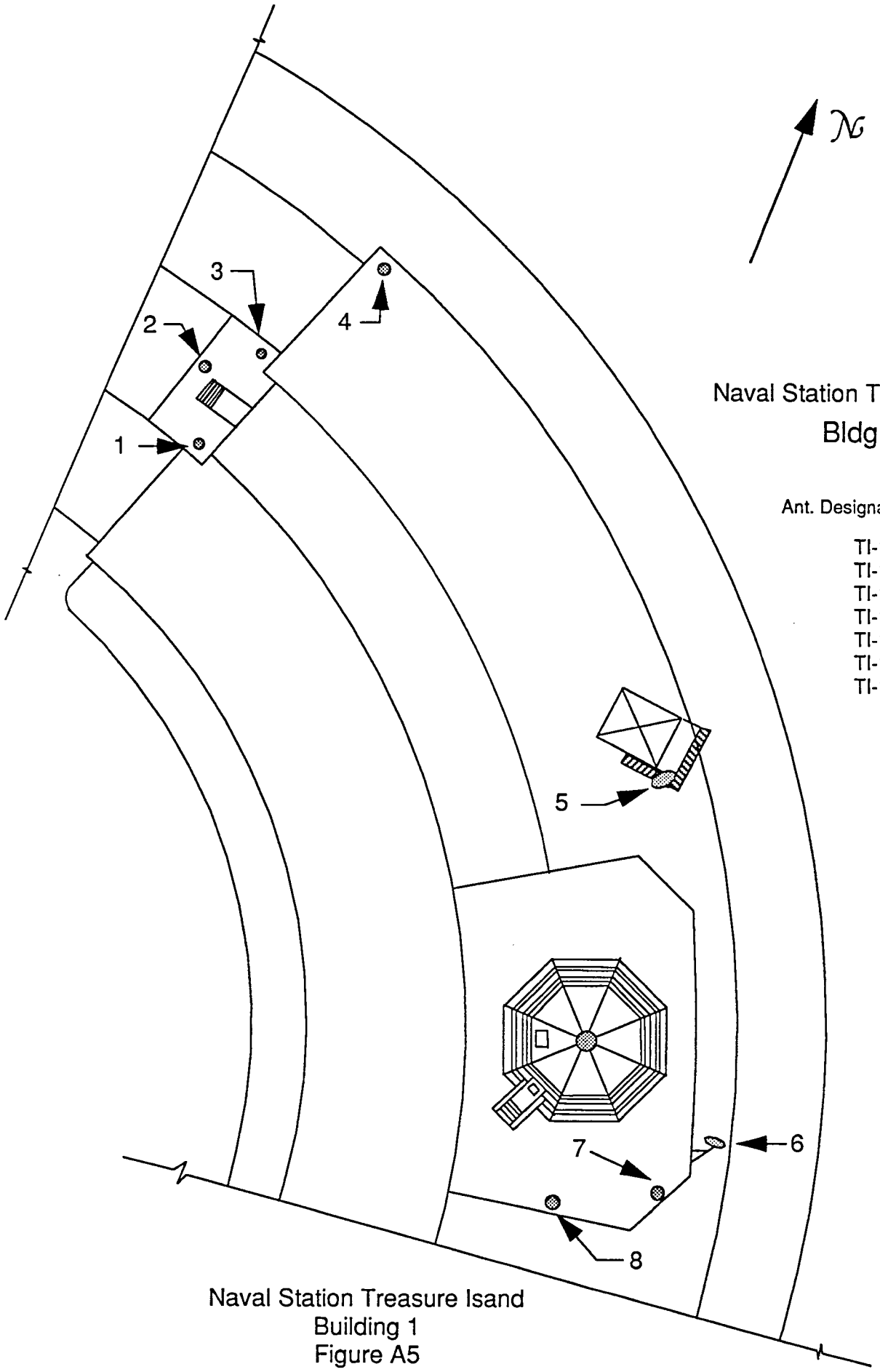


Ant. Ref.	Ant. Loc.
YBI-229.1	Bldg. 229
YBI-229.2,7	Bldg. 229
YBI-229.3	Bldg. 229
YBI-229.4	Bldg. 229
YBI-229.5	Bldg. 229
YBI-229.6	Bldg. 229
YBI-229.8	Bldg. 229

Ant. Ref.	Ant. Loc.
YBI-POLE2.1	Pole # 2
YBI-POLE2.2	Pole # 2
YBI-POLE3.1	Pole # 3
YBI-POLE3.2	Pole # 3
YBI-POLE3.3	Pole # 3
YBI-POLE4.1	Pole # 4
YBI-POLE4.2	Pole # 4
YBI-POLE4.3	Pole # 4

Ant. Ref.	Ant. Loc.
YBI-TWR1.1,2	Tower # 1
YBI-TWR1.3,7,8	Tower # 1
YBI-TWR1.4,5,6	Tower # 1
YBI-TWR1.9	Tower # 1
YBI-TWR2.1	Tower # 2
YBI-TWR2.2	Tower # 2
YBI-TWR2.3	Tower # 2

Bldg. 118/229/278
Figure A4



Naval Station Treasure Island
Bldg. 1

Ant. Designator	Map Loc.
TI-1.1	1
TI-1.2	2
TI-1.3	3
TI-1.4	4
TI-1.5	5
TI-1.6	6
TI-1.7	7

Naval Station Treasure Isand
Building 1
Figure A5
A6

APPENDIX B

EQUIPMENT TESTED

2.1.2 Transmitter Facilities on Treasure Island & Hunters Point

(also see Appendix A)

Responsibility	Building Location
Naval Support Activity	TI-1
U.S. Naval & Marine Reserve Center	TI-2
Port Services T.I.	TI-3
Naval Station T.I. Security	TI-107
Naval Station T.I. Brig	TI-222
MOTU-9	TI-230
Naval Medical Clinic San Francisco	TI-257
Naval Station T.I. Public Works	TI-264
Naval Transit Personnel Unit	TI-366
Naval Station Admin. & Legal	TI-450
T.I. Housing	TI-1240 Northpoint
T.I. Housing	TI-1215 Bayside
FF-1052 Class Fast Frigate	TI-Pier 1
Yerba Buena Is., Coast Guard Station	YBI-TWR1
California Highway Patrol	YBI-TWR2
NAVSTA T.I. Public Works	YBI-POLE 2,3,4
Naval Station T.I. Security	YBI-229
Naval Station T.I. Fire Department	YBI-229
California Highway Patrol	YBI-229
SERGRU ONE	YBI-229
NISO	YBI-229
NAVSUPSHIP	HPA-146
NAVSUPSHIP	HPA-253
NAVSUPSHIP	HPA-322
Mare Island Naval Shipyard	HPA-351
NAVSUPSHIP	HPA-381
NAVSUPSHIP	HPA-413
Naval Station T.I. Fire Department	HPA-715
NAVSUPSHIP	HPA-813

TRANSMITTERS TESTED
at
NAVAL STATION TREASURE ISLAND

Bldg-Antenna. Location	Transmitter System Name	Freq. MHz	HERP ft.*	EMC ft.*	Hazard Distance ft.#	Comments and Notes:
TI-1.1	ICOM M-55	145	1	120	NO HAZARD	
TI-1.2	MCX-100 MOT	143.6	3.9	260	NO HAZARD	
TI-1.4	MOTOROLLA MCX-100	142.65	3.0	200	8"	
TI-1.4	AN/WRC-1	6	2.9	180	2.5	
TI-1.5	FRC-149	7798.5	1.0	N/A	0"	
TI-1.6	FRC-149	7705	1.0	N/A	0"	
TI-1.7	AN/GRC-171	300	1.7	120	6"	
TI-2.1	RT-1195/ TPS-66	9405	1	N/A	NO HAZARD	Reserve van
TI-2.2	RT-698/ARC-120	30	3.6	220	3	Reserve van ; warning signs were posted
TI-2.3	AN/URC-35B	27	2	120	NO HAZARD	
TI-2.4	AN/ARC-159	300	1	65	NO HAZARD	Reserve van
TI-2.5	AN/ARC-131	50	1	65	NO HAZARD	Reserve van
TI-3.1	SR-204	2.434	4.1	260	NO HARZARD	
TI-3.2	ICOM IC-M55	156.8	1.9	120	NO HAZARD	
TI-3.3	MOT MCX-100 L44JJB	150.65	2.3	140	NO HAZARD	
TI-107.	MICOR C73RXB	149.65	3.6	220	NO HAZARD	T.I. SECURITY
TI-222	STANDARD GX-3000	148.3	2	140	NOT MEASURED	Not able to coordinate visit
TI-230.1	SPS-64	9375	4	N/A	2	
TI-230.2	LN66	9375	1.69	N/A	1"	PEL exceeded at radome
TI-230.3	AN/SPS 10	5500	1.0	N/A	6"	
TI-257	GE SC76TEP56C	149.4	5.4	340	0"	Could not obtain a reading even while touching the antenna
TI-264.	MCX-100	138	3.93	260	1	Antenna cable has RF leak

* These distances were calculated using NAVSHIPS Computer Program "On Axis Power Density in the Fresnel and Fraunhofer Region" NAVSHIPS 0900-006-5240 & NAVSHIPS 0900-006-5250. Modified to include communications antennas.

These distances are from actual measurements performed during the survey. They are the minimum required personnel safe separation distances under the survey testing conditions. If "NOT MEASURED" is listed in this column then the theoretical distance in the HERP column must be used.

TRANSMITTERS TESTED
at
NAVAL STATION TREASURE ISLAND
(cont.)

Bldg-Antenna. Location	Transmitter System Name	Freq. MHz	HERP ft.*	EMC ft.*	Hazard Distance ft.#	Comments and Notes:
TI-366.	MOTL-4JJB MCX-100	142.65	2.2	140	1.5	
TI-450	KING 7001	156.5			2	Base-loaded antenna
TI-1215.1	ICOM IC-280	145	1.5	100	NOT MEASURED	1215 E BAYSIDE DR
TI-1215.2	KENWOOD TS 130S	30.0	9.0	560	NOT MEASURED	1215 E BAYSIDE DR
TI-1215.3	KENWOOD TS 130S	30.0	4.6	300	NOT MEASURED	1215 E BAYSIDE DR
TI-1240	YAESU 757GX	15	5.8	360	NOT MEASURED	1240 NORTHPOINT DR,.Colinear and wire antenna within reaching distance of ground
TI-PIER-1	AN/SPG-53F	9600	72.5	N/A	NOT MEASURED	
TI-PIER-1	LN66	9375	1.69	N/A	NOT MEASURED	PEL exceeded at radome
TI-PIER-1	AN/SPS 10	5500	1.0	N/A	NOT MEASURED	
TI-PIER-1	AN/SRN-15	1000	1.0	N/A	NOT MEASURED	
TI-PIER-1	MK 76	1000	76.1	N/A	NOT MEASURED	
TI-PIER-1	SPS-40C	420	168.5	N/A	NOT MEASURED	
TI-PIER-1	WSC-3	400	2.1	140	NOT MEASURED	
TI-PIER-1	WSC-3	306	6.3	400	NOT MEASURED	
TI-PIER 1	AN/URC-46	50	2.0	140	NO HAZARD	
TI-PIER-1	AN/URT-23	30	11.6	720	NOT MEASURED	
TI-PIER-1	AN/URT-24	30	4.1	260	NOT MEASURED	

* These distances were calculated using NAVSHIPS Computer Program "On Axis Power Density in the Fresnel and Fraunhofer Region" NAVSHIPS 0900-006-5240 & NAVSHIPS 0900-006-5250. Modified to include communications antennas.

These distances are from actual measurements performed during the survey. They are the minimum required personnel safe separation distances under the survey testing conditions. If "NOT MEASURED" is listed in this column then the theoretical distance in the HERP column must be used.

TRANSMITTERS TESTED
at
HUNTERS POINT ANNEX

Bldg-Antenna. Location	Transmitter System Name	Freq. MHz	HERP ft.*	EMC ft.*	Hazard Distance ft.#	Comments and Notes:
HPA-146	MAXI STAND. MARINE	156.8	2.067	140	NO HAZARD	
HPA-253	MOTOROLLA SP380	138.975	4.1	240	NO HAZARD	
HPA-253	TA101	3.3104	1	90	NO HAZARD	
HPA-322	MOTOROLLA MAXAR 80	469.5	1.7	140	NO HAZARD	
HPA-351	MOTOROLLA	140.975	3.2	200	NO HAZARD	
HPA-351	MOTOROLLA	140.550	3.2	200	NO HAZARD	
HPA-351	MOTOROLLA	140.525	3.2	200	NO HAZARD	
HPA-351	MOTOROLLA	140.500	3.2	200	NO HAZARD	
HPA-381	MOTOROLLA MCX 100	148.425	2.3	140	NO HAZARD	
HPA-413	APELCO MARINE	156.8	2.1	140	NO HAZARD	
HPA-413	COLLINS 59	138.975	4.1	240	NO HAZARD	
HPA-813	COLLINS 59	140.875	4.1	240	NO HAZARD	

* These distances were calculated using NAVSHIPS Computer Program "On Axis Power Density in the Fresnel and Fraunhofer Region" NAVSHIPS 0900-006-5240 & NAVSHIPS 0900-006-5250. Modified to include communications antennas.

These distances are from actual measurements performed during the survey. They are the minimum required personnel safe separation distances under the survey testing conditions. If "NOT MEASURED" is listed in this column then the theoretical distance in the HERP column must be used.

TRANSMITTERS TESTED
at
YERBA BEUNA ISLAND

Bldg-Antenna. Location	Transmitter System Name	Freq. MHz	HERP ft.*	EMC ft.*	Hazard Distance ft.#	Comments and Notes:
YBI-1.1	KENWOOD TS-130S	30	4.6	300	NO HAZARD	
YBI-1.2	ICOM IC-280	146.85	1.3	85	NO HAZARD	
YBI-229.1	S174RBU33A	42.12	4.1	260	5	CA. Highway Patrol. Transmitters RF radiation coupled into building's vent pipe.
YBI-224.2,7	AN/URC-85 UHF	310	3.3	220	6"	
YBI-229.3	MOTC71RTB	47.04	4.1	260	2	CA. Transportation
YBI-229.4	MSR2000 C73KSB	148.425	3.5	220		T.I. Police and Fire Departments
YBI-229.5	MOT C73RCB314	140.775	2.7	180	1	
YBI-229.6	???	????	??	N/A	????	Montery Amateur Repeater; Unable to obtain information or measurements
YBI-229.8	AA-71	1.65	1	80	NOT MEASURED	Not installed as of 7/3/88
YBI-POLE2.1	UNKNOWN	150	4	260	NO HAZARD	T.I. PUBLIC WORKS X-mitter is located in BLDG.118
YBI-POLE2.2	MOTC73RTB1105	148	4.8	300	NOT MEASURED	Not used at this time
YBI-POLE3.1	DC76AU56D	138	4.5	280	NO HAZARD	
YBI-POLE3.2	C73KSB3106AT	143	4.1	260	NO HAZARD	
YBI-POLE3.3	DC76AU56D	143	3.2	200	NO HAZARD	
YBI-POLE4.1	RITRONAIE90ZRA452	453.912	2.1	160	NO HAZARD	
YBI-POLE4.2	RITRONAIE0ZRA452	453.937	2.1	160	NO HAZARD	
YBI-POLE4.3	MOT C64RCB3125A	453.85	5	400	NO HAZARD	
YBI-TWR1.1,2	AN/FPS-121	9410	1	N/A	NO HAZARD	
YBI-TWR1.3,7,8	GRANGER 6018A	1710	1	N/A	NO HAZARD	
YBI-TWR1.4,5,6	MOT16RBF1200	1800	16.49	N/A	NO HAZARD	NAVHOSP Oakland
YBI-TWR1.9	MOTC53MHB1106	140	3.4	220	NO HAZARD	

* These distances were calculated using NAVSHIPS Computer Program "On Axis Power Density in the Fresnel and Fraunhofer Region" NAVSHIPS 0900-006-5240 & NAVSHIPS 0900-006-5250. Modified to include communications antennas.

These distances are from actual measurements performed during the survey. They are the minimum required personnel safe separation distances under the survey testing conditions. If "NOT MEASURED" is listed in this column then the theoretical distance in the HERP column must be used.

TRANSMITTERS TESTED
at
YERBA BEUNA ISLAND
(cont.)

Bldg-Antenna. Location	Transmitter System Name	Freq. MHz	HERP ft.*	EMC ft.*	Hazard Distance ft.#	Comments and Notes:
YBI-TWR2.1	MICROWAVE ASOC MA6	6855	1	N/A	NO HAZARD	
YBI-TWR2.2	MICROWAVE ASSOCMA6	6635	1	N/A		
YBI-TWR2.3	GRANGER	9560	1	N/A	NO HAZARD	

* These distances were calculated using NAVSHIPS Computer Program "On Axis Power Density in the Fresnel and Fraunhofer Region" NAVSHIPS 0900-006-5240 & NAVSHIPS 0900-006-5250. Modified to include communications antennas.

These distances are from actual measurements performed during the survey. They are the minimum required personnel safe separation distances under the survey testing conditions. If "NOT MEASURED" is listed in this column then the theoretical distance in the HERP column must be used.

APPENDIX C

TEST EQUIPMENT UTILIZED

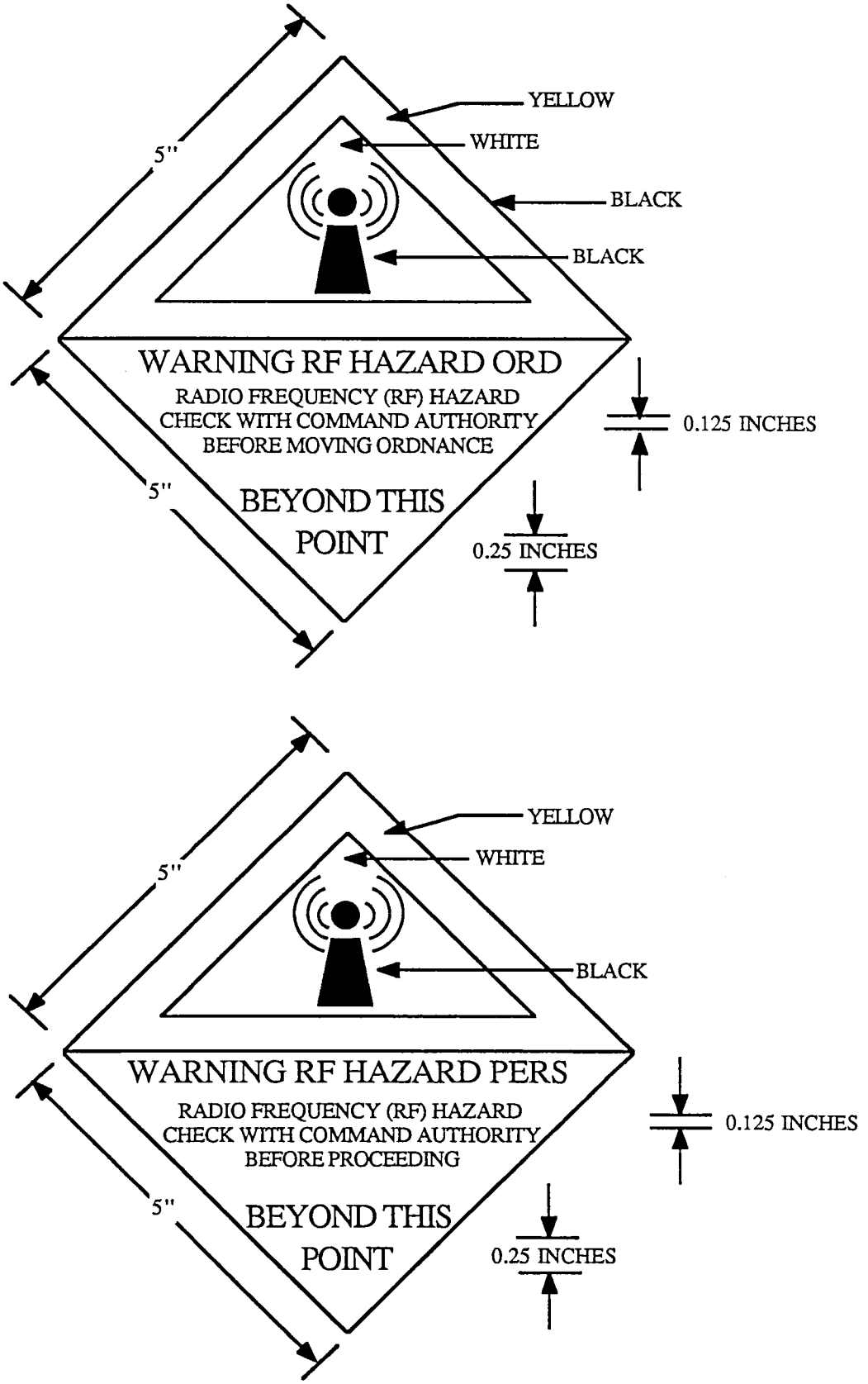
TEST EQUIPMENT UTILIZED

Equipment Name	S/N#
HP 435A Power Meter	2445A11424
Holaday HI-3002	39766
E-Field Probe	1027HR
H-Field Probe	261
Narda 8616	15610
Penril Portable Receiver	299

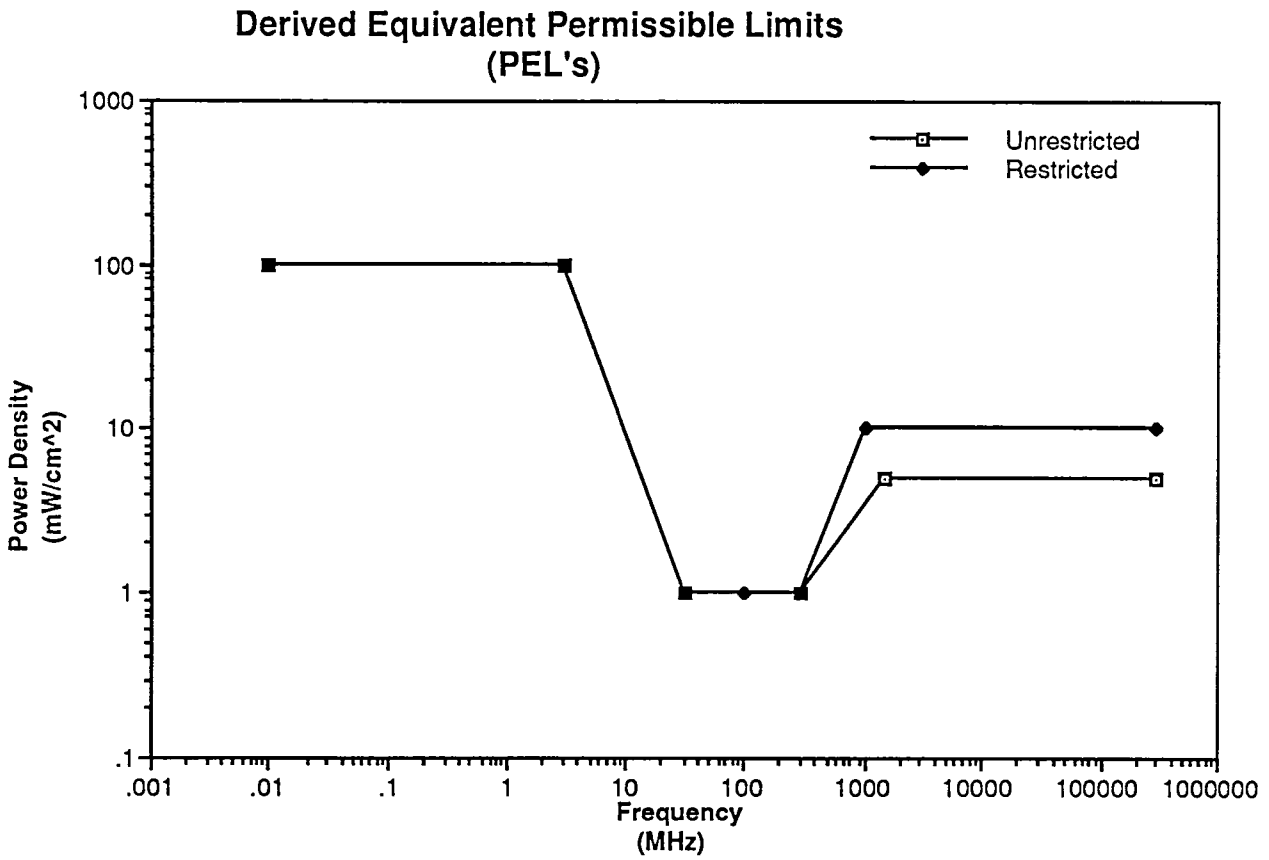
(all test equipment operational and in calibration)

APPENDIX D

LIMITS AND STANDARDS



ANSI C95.1-1982 RF Warning Sign
Figure D1



NOTES:

1. Restricted areas are those to which access is controlled for the purpose of excluding entry of persons of less than 55 inches in stature.

2. Unrestricted ares are those areas where access in not controlled to exclude persons of less than 55 inches in stature.

3. Graph only applies to whole body exposures and are based on overall PEL of .4 W/kg .

Table 1A
D3

APPENDIX E

DEFINITION OF TERMS

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Electric Field - (E-Field) A fundamental component of RF electromagnetic waves, which exists when a voltage potential difference exists between two points in space. (See Field Strength).

Electroexplosive Device - (EED) Any single discrete unit, device, or subassembly whose actuation is caused by the application of electric energy which, in turn, initiates an explosive, propellant, or pyrotechnic material contained therein. The term electroexplosive device does not include complete assemblies which have electric initiators as subassemblies, but includes only subassemblies themselves. Synonymous with electric initiator.

Electromagnetic Interference - (EMI) Electromagnetic disturbance which manifests itself in performance degradation, malfunction, or failure of electrical or electronic equipment.

Emitter - (in the context of this report) any antenna radiating or giving off electromagnetic energy.

Far Field - (Fraunhofer region, plane wave region). The region far from an antenna, compared to the size of the antenna and the wavelength of the radiation, where the power decreases with the square of the distance from the source. In this region the radiation has the properties of a plane wave. (See Plan Wave).

Field Strength - The magnitude of the electric field (in volts/meter) or magnetic field (in amps/meter).

Hazards of Electromagnetic Radiation to Fuels - (HERF) HERF is the danger of igniting volatile combustibles by spark ignition due to radio frequency electromagnetic fields of sufficient intensity.

Hazards of Electromagnetic Radiation to Ordnance - (HERO) HERO is the danger of actuating electroexplosive devices (EEDs) of otherwise activating ordnance due to radio frequency electromagnetic fields of sufficient intensity.

Hazards of Electromagnetic Radiation to Personnel - (HERP) HERP is the danger of producing harmful biological effects in humans by exposure to radio frequency electromagnetic fields.

Magnetic Field - (H-Field) A fundamental component of RF electromagnetic waves, produced by a moving electric charge. (See Field Strength).

Minimum Separation Distances - Distance, determined by measurements or theoretical calculations, at which the field strength for an emitter reaches a level where the E^3 discipline of concern (i.e. EMI, HERF, HERO, or HERP) is no longer a potential problem in light of present engineering knowledge.

Near Field - The electromagnetic field which exists relativity near the radiation source. In this area the electric and magnetic fields do not exhibit a plane wave relationship, and the power does not decrease with the square of the distance from the source. The near field region is further subdivided into the reactive near field region, which is closest to the antenna and contains most or nearly all of the stored energy associated with the field of the antenna, and the radiating near field region, where the radiation field predominates over the reactive field but lacks substantial plane wave character and is complicated in structure.

Permissible Exposure Limit (PEL) - The maximum level expressed in derived equivalent power density, electric field strength, or magnetic field strength to which an individual may be exposed which, under the conditions of exposure, will not cause detectable bodily injury in light of present medical knowledge.

Plane Wave - An electromagnetic wave characterized by mutually orthogonal electric and magnetic fields which are related by the impedance of free space (377 ohms).

Power Density - The amount of power per unit area in an electromagnetic field, usually expressed in milliwatts per square centimeter or watts per square meter.

Radio frequency Radiation (RFR) - Electromagnetic radiation at frequencies between 10 kHz and 300 GHz.

Restricted Access Area - Any area access which is controlled for the purpose of excluding entry of persons of less than 55 inches in stature.

Specific Absorption Rate (SAR) - The time rate at which RFR energy is imparted to an element of mass of a biological body usually measured in W/kg or normalized to incident power density in W/kg/mW/cm2.

Unrestricted Access Areas - Any area that is not controlled and all persons may enter.